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Participatory landscape analysis for community-based livestock management in Vietnam

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Introduction

In Vietnam, privatisation of the economy, land redistribution and the political reforms of the late 1980s profoundly changed local institutions and the social relations among households with respect to agricultural production. The *doi moi* (renovation) policy dramatically boosted agricultural production across the country. It also changed the way natural resources were managed and brought questions about the sustainability of current practices to the forefront, especially in the fragile upland ecosystems. The Mountain Agrarian Systems Programme started in 1998 with the main objectives of improving:

- agricultural productivity;
- natural resources management; and
- the living standards of highlands ethnic minority groups .[1]

This action research project is made of two components:

- the diagnosis of land use changes and problem prioritisation with local stakeholders; and
- the intervention through design and the testing, in partnership with farmers and extension services, of technical and organisational innovations. [2]

The programme aims to understand factors related to designing sustainable cropping systems, and to develop new tools to facilitate decision-making processes for rural development and natural resource management (Castella *et al.*, 2004).

Livestock free-grazing appeared when former collective livestock was distributed to individual households. Today, roaming buffaloes and cattle continue to be an obstacle to agricultural intensification in both upland and lowland areas. Land use and livestock management systems are interdependent, and neither can be properly analysed without regard for the other. It is important that all partners in the development process understand this. Conflicts between households with different farming and livestock management practices are becoming more and more frequent. We identified the spatial organisation of forage resources and farmers' livestock feeding practices as important dimensions of sustainability (Eguienta *et al.*, 2002). It is thus necessary to understand spatial organisation at the village/watershed scale

[1] The Mountain Agrarian Systems Programme is a joint research project between the Vietnam Agricultural Science Institute (VASI, Vietnam), Institut de Recherche pour le Développement (IRD, France), Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD, France), and the International Rice Research Institute (IRRI, Philippines).

[2] For further information see the project website at: www.knowledgebank.irri.org/sam/home_en.html

Figure 1a: First stage in 3-dimensional modelling: constructing the relief model made of sheets of cardboard cut along contour lines

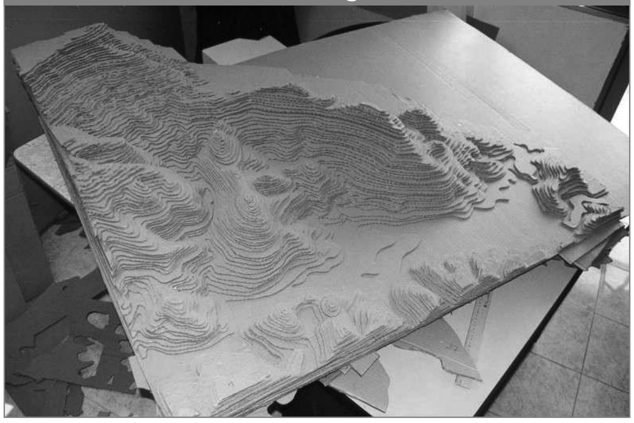


Photo: YK Eguienta

Figure 1b: Second stage in 3-dimensional modelling: documenting the blank relief model with local stakeholders

Photo: YK Eguienta

Box 1: Process and criteria for selecting participants to the participatory landscape analysis in Phieng Lieng village

Thirty people were selected to document the 3D model according to the following criteria: age, gender, place of residence, kinship, ethnicity, wealth, and crop-livestock management strategies based on the typology of farming systems by Eguienta *et al.* (2002). The question of unequal communication skills was solved by creating small working groups of people who were more knowledgeable on the particular topic of each session. In addition, all villagers holding important positions in the local government and mass organisations, those involved in project activities as well as informal opinion leaders were interviewed. Key informants were identified through discussions and interviews with the local government, extension workers and project field staff. Ten participants were then selected to help design the graphic model. They were selected according to their knowledge of different areas in the village, either because their house was located there or because they cropped some plots, tended animals or collected forest products in these particular sites. They were asked to draw their village. School children aged eight to 12 were also asked to draw their village as homework. The drawings revealed a marked influence of people-specific knowledge on their perception of the village landscape. For example, children who usually tend the buffalo herd represented large pasture areas as compared to adults who rarely go to the most remote areas in the village.

as well as spatial dynamics in both the short-term (less than one year) and long-term (historical changes). However, this understanding is not sufficient for actions to succeed. To go beyond a diagnostic study and its usual 'list of recommendations', we need to understand the underlying social organisation of the community, as well as its historical evolution and response to policy and institutional changes. Changes in the spatial management of livestock systems require transformations in social organisation. In this paper, we present a method to facilitate such a collective learning process. A case study implemented in Phieng Lieng village (Ngoc Phai commune, Bac Kan province) demonstrates an effective mechanism for fruitful dialogue between an interdisciplinary team of scientists and local stakeholders with respect to livestock systems and spatial management of natural resources.

Method: combining local and scientific knowledge in a common graphic language

Capturing local knowledge into a Geographic Information System (GIS)

We used a three-dimensional relief model as a mediating tool between the team of researchers and villagers (Rambaldi *et al.*, 2000). We re-scaled the topographic map from 1:10,000 to 1:3000 as a reference for a stand-alone relief model. Layer by layer, a blank model was cut from sheets of cardboard and then assembled on a transportable frame (Figure 1a). The relief model allowed a participatory approach to the mapping of village resources and landscape features.

A preliminary analysis of stakeholders led to the selection of 30 participants according to the criteria presented in Box 1. We began to fill in the blank relief model by locating and naming the main features of the landscape: rivers, mountain peaks, road, tracks, etc. Participants identified other relevant village landmarks (e.g. wooden fences, natural barriers). The next meetings tackled land cover, land use, land tenure and historical changes. Participants used coloured yarns to delineate the main types of land use, and identified their houses with pushpins (Figure 1b). We eventually agreed

Figure 1c: Third stage in 3-dimensional modelling: capturing local knowledge on spatial management of natural resources

Photo: YK Eguienta

Figure 1d: Fourth stage in 3-dimensional modelling: transferring the spatial information by projection on a grid plastic sheet

Photo: YK Eguienta

on what information we would show (land use and land cover classes, land tenure classes, etc.) and how we would present it on the model (e.g. coloured surfaces, lines, points). This was an essential stage, as it ensured that the information shown on the model would be meaningful to participants, researchers and villagers alike. After this consensus was reached, the individual features were painted on the model according to the agreed coding system (Figure 1c).

After each thematic session, a Plexiglas sheet attached to an aluminium frame was overlaid on the relief model, and the theme's relevant points, lines and polygons were projected onto a geo-referenced grid (Figure 1d). Information about land cover, land use and land tenure systems at different historical periods could then be transferred from the 3D model to geo-referenced paper maps, and then digitised and incorporated into a village-scale Geographic Information System (GIS).

The same relief model was later used to support discussions during interviews with individual households. The first three farmers were selected to represent the three main types of farming systems that had been identified in an earlier exhaustive household survey (76 households, Eguienta *et al.*, 2002). In addition to traditional questions about household economics, working calendars and how activities were shared between men and women, we asked farmers to locate on the 3D model the activities that had been discussed. The main spatial features of individual resource management and agricultural production practices were captured on the relief map and transferred into the GIS. For validation, five more farmers were interviewed with the support of a sketch map to represent their individual practices. The whole process of documenting the 3D model, data gathering about farmers' spatial management of natural resources, and transfer into the village GIS, was spread over one month.

Graphic models as discussion tools

The map development process gave the participants a better integrated vision of their environment, and the village now had an attractive landscape model and some new maps, but little else to show for the effort. The geographic representation had been necessary for diagnostic purposes and analysis of a possible scenario, but was not a satisfactory medium for researchers to present the results of their analysis to the local community. Yet the maps were still too abstract for use as discussion tools. On the other hand, the 3D model was too close to reality to discuss collective scenarios without triggering individual reactions from people who either lived there or had resources at stake. Our conventional geographic representations could display neither dynamic scenarios nor the movement of livestock nor management practices. We clearly needed a more abstract model before we could begin to present concrete scenarios. So we resumed the process of developing a common spatial language with the help of the village community.

We divided the village into a number of compartments based on land use and major geographic features. We represented the rice fields at the lowest part of the village with a large yellow oval on the graphic model. We represented the mountain chains surrounding the village with solid lines, splitting the uplands into two clear watersheds (Lung Khieng and Lung Vai areas), each with one stream at its base. One upland zone was close to the village residential area and devoted to

Figure 2: From a conventional topographic map (A) to a spatial graphic framework (B)

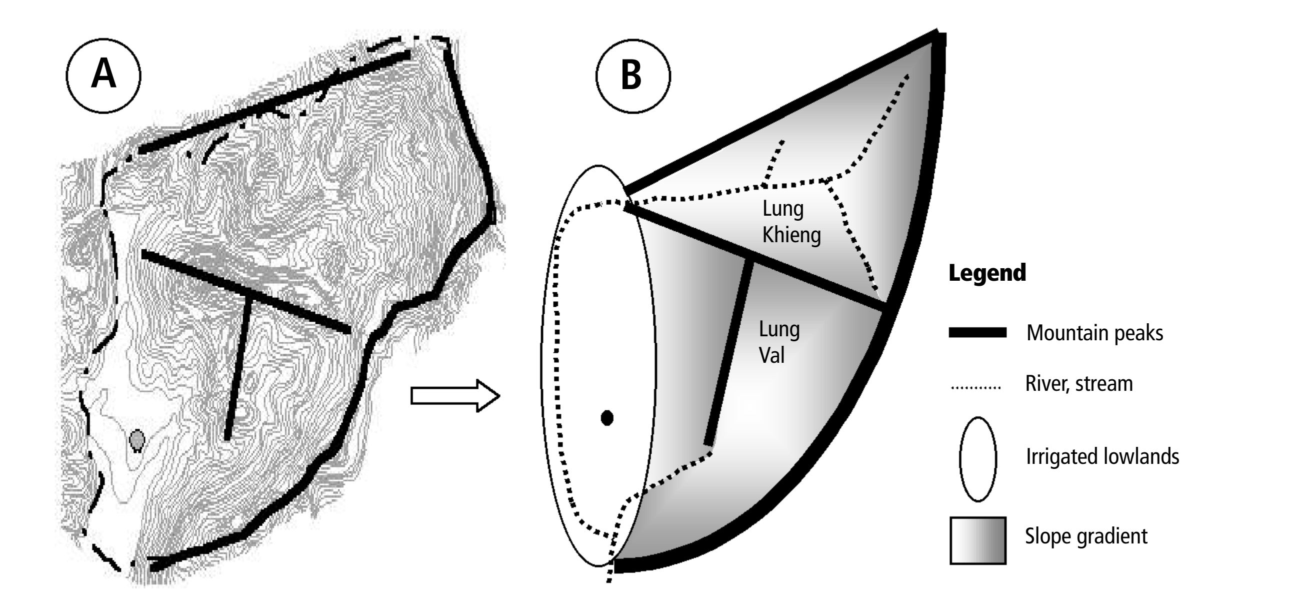
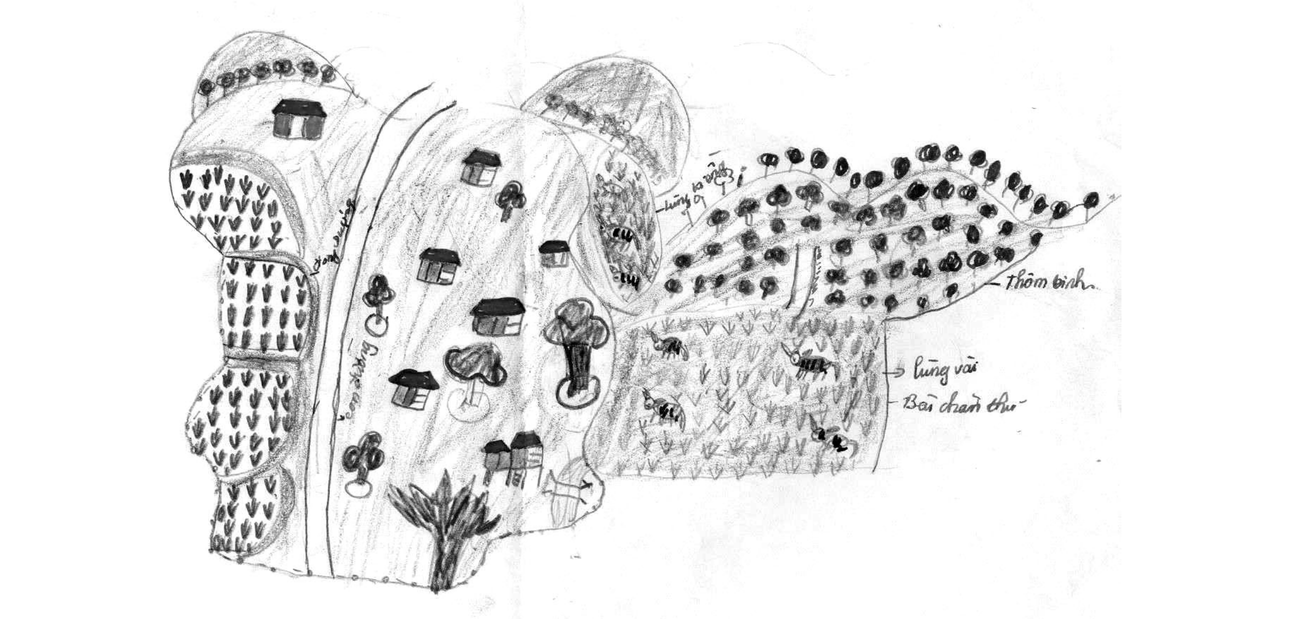


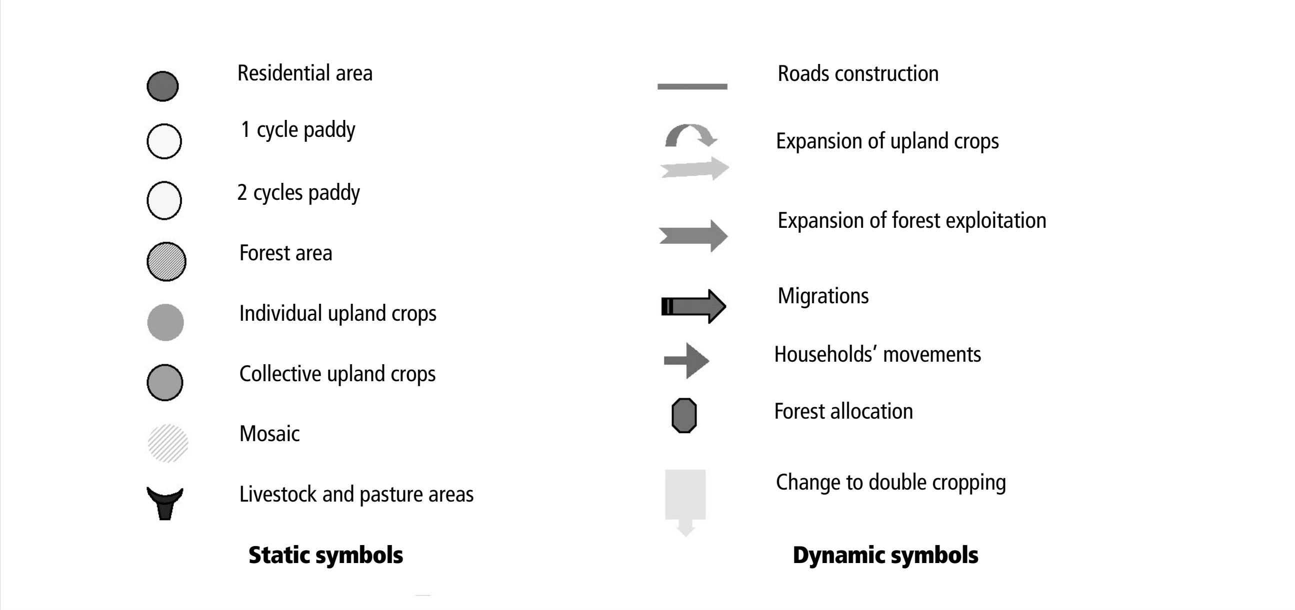
Figure 3: Example of village drawing by school children and local participants (Drawing by Luong Thi Uyen)



short rotation intensive cropping systems, while the other more remote area was further up the mountain in a forested area (Figure 2).

We represented the village's spatial organisation and dynamics with a set of graphic codes. Once the graphic framework was designed, these elementary shapes would become the alphabet of the common language we were developing. We needed shapes that would be meaningful to anybody who would need to communicate in the graphic language, so we asked villagers and schoolchildren to draw

Figure 4: Graphic symbols used in the hands-on spatial graphic modelling process



their village (Figure 3). The drawings validated our graphic representation of the village and identified the ways that locals represented the main land use systems, livestock and other components of the landscape. With the help of local people and researchers from different disciplinary backgrounds (i.e. geography, agronomy, sociology), we developed the symbolic language shown in Figure 4.

Finally, during a one-day meeting held in October 2001, we presented our spatial representations, graphic codes, and scenarios to a panel of 16 villagers selected according to the criteria in Box 1 and representing the main groups of local stakeholders (i.e. farmers, local authorities, Women's Union, etc.). These were all understood by the participants, validating both the participatory learning process and its resulting graphic outputs. Participants agreed that the graphic representations:

- really did capture the geography of their village and its history;
- were meaningful and relevant for decision-making; and.
- could be useful for collective action.

Results: from individual to collective livestock management

Examination of official land use plans in the light of actual land use revealed that some individual households were cultivating in common upland and even protected areas. In the upper part of the watershed where natural barriers do not exist, competing land uses had developed. Strong fences and/or trenches to prevent damage by animals had made the actual livestock grazing area smaller than it appeared on the land-use planning maps. The poor quality of over-grazed pastures encouraged buffaloes and cattle to roam in protected forest areas and they had also become a source of conflict with the neighbouring village (Eguienta *et al.*, 2002).

A closer look at the individual management of natural resources over time revealed three main strategies according to households' resource endowments (i.e. land, labour and capital):

- **Type A** farms rely mainly on the lowlands for agriculture and on the upper part of the watershed for timber and livestock activities;
- **Type B** farms rely on all tiers of the watershed (i.e. rice in the lowlands, upland crops near the village, and livestock in the more remote areas); and,
- **Type C** farms rely mainly on the upper part of the watershed for upland crops, livestock, and gathering forest products.

Their different strategies explain the different livestock management practices. They also show that there is no simple solution to the village's crop-livestock integration problems (Eguienta *et al.*, 2002). Any sustainable solution will have to rely on a consensus between these three types of

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Table 1: Distribution of main income-generating activities according to gender (♀♂), time of year, and location (numbers from one to five from Figure 5) and livestock management calendar.

Months		Jan Feb	Mar Apr	May Jun	Jul Aug	Sep Oct	Nov Dec
Paddy fields		♀♂ (I)	♀ (I)	♀♂ (I)	♀ (I)	♀♂ (I)	
Upland crops			♀ (II, IV)	♀♂ (II, IV)		♀♂ (II, IV)	
Bamboo stems					♀♂ (III, IV)		
Bamboo shoots		♀ (III, IV)					
Fuel wood			♂ (V)		♂ (V)		♀♂ (III, V)
Timber wood			♂ (III, V)		♂ (III, V)		♂ (III, V)
Non-Timber FP							♀ (III, IV)
Off-farm			♂		♂		♀♂
Livestock	Draft power	Ploughing (I)	Wood collect (III)	Ploughing (I)	No work or wood (III, IV)	No work (IV)	Wood collect (III)
	Manage-ment	Tended (I)	Roaming or tended (I, IV)	Tended (I)	Roaming (IV)	Tended (I, IV)	Tended or Roaming (I, IV)
	Fodder	Straw, tree leaves, grass (I, IV)	Grass, tree leaves (IV)	Straw, tree leaves, grass (I, IV)	Grass, tree leaves (IV)	Grass, tree leaves (I, IV)	Straw, tree leaves, grass (I, IV)

households and is what makes the development of a common spatial language so important in reaching an agreement on a collective crop-livestock development plan.

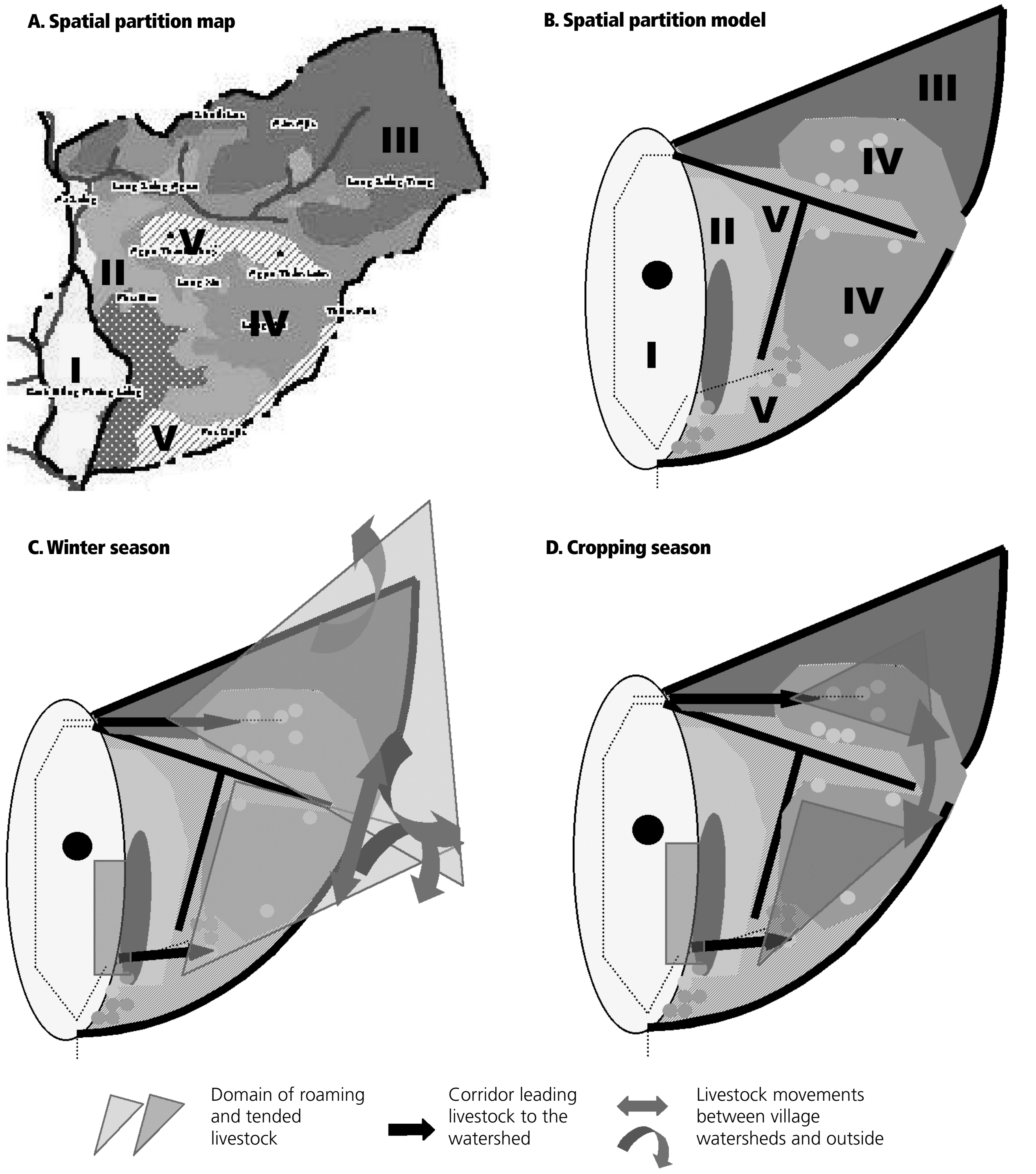
Our survey showed that the time dimensions of farmers' practices were as important as the spatial dimensions (Rambaldi *et al.*, 2000), as seasonal variations are apparent in the location of different activities. In collaboration with the farmers, we identified a set of homogeneous periods in terms of activities and natural resource management rules (Table 1). We then located each activity on the landscape model. The resulting spatial division of the village is given in Figure 5. A clear distinction appears between two periods. The absence of crops during the winter season allows animals to roam more freely, but the winter nevertheless remains a very critical period for animals because of the shortage of natural grass. Most gathering of forest products also takes place in winter, with the exception of bamboo products. The crop season can be divided into four sequences corresponding to the first and second part of each of the two crop cycles, in both lowlands and uplands. Livestock are kept close to the village for land preparation during the first part of each season and are then used to move wood from the forest located in the higher parts of the watershed. There is thus a strong seasonal division of household activities related to crops, livestock and gathering forest products.

We developed new maps and models to facilitate discussions on seasonal changes in spatial organisation (Figure 5) and used them to represent individual household practices and assess their compatibility with other households' practices or with collective village rules. The division of the landscape according to locally practiced resource management rules is shown in Figures 5a and 5b. Researchers and villagers jointly designed scenarios representing current crop-livestock interactions (Figures 5c and 5d).

Discussion and conclusion

The graphic models have been used as a mediation tool for discussions about spatial conflicts between crop intensification and livestock development. Participants were very receptive to the approach and the collective learning experience is ongoing, as we are continuing to design scenarios for the development of a sustainable crop-livestock-forest system in Bac Kan Province. The next step has been to use this model to support discussions with local stakeholders about the introduction of technical and organisational innovations regarding livestock feeding systems. Once the main constraints at the village scale had been identified, especially concerning forage resources for buffaloes and cattle, farmers were able to simulate on paper the adoption of different innovations (e.g. alternative cropping systems under cover crop, urea treatment of rice and maize straw, regulations on roaming animals, down-

Figure 5: Spatial division of the village according to natural resource management practices (A, B) and the movement of buffaloes during the winter season (C) and the cropping season (D).



sizing of the village herd). They then received project support in order to reproduce, in their own plots, the results of their simulation. In the long run, it would be possible to transform the simulations of technical interventions by individual farmer into role-plays involving several participants (Castella *et al.*, 2004). This would mean going from an individual model of adoption of innovation to the collective management of resources at the scale of the village community.

The method presented here is intended to complement other participatory approaches. A major step towards problem solving is to formulate development questions from both scientists' and local stakeholders' viewpoints in a language understood by all partners, despite the inherent complexity of problems involved in productivity versus sustainability. Used as a participatory diagnostic tool, the spatial graphic models were tremendously useful, as the sustainability of an agro-ecological system can often be seen as a problem of compatibility between the household and village levels. The experiments conducted in Phieng Lieng and other action research sites in Bac Kan have shown that local people are extremely interested in receiving support for the individual decisions they need to make. The role of the researcher as facilitator is to find a context where individual behaviour will be compatible with the common good. It will then become possible to use the mediation tools developed to create sustainable collective management of natural resources.

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